Back to the future: how human induced pluripotent stem cells will transform regenerative medicine.

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Public Summary:
Regenerative medicine is a new and expanding field that aims to replace lost or damaged tissues in the human body through either cellular transplantation or self repair. The ability to reprogram adult cells back to a pluripotent state has recently moved the regenerative medicine field to a new and exciting level. It was revolutionary when human adult skin cells, and subsequently other adult cell types, could be sent back in time to an embryonic-like state by simply having the adult cells express powerful pluripotency transcription factors. These induced pluripotent stem cells (iPSCs) provide new possibilities for disease modeling, organ generation, cellular transplantation and even rejuvenation. In addition to expanding our knowledge of human disease and potential treatments, the iPSC technology may even begin to elucidate the mechanisms of and reasons for human aging.

Scientific Abstract:
Based on cloning studies in mammals, all adult human cells theoretically contain DNA that is capable of creating a whole new person. Cells are maintained in their differentiated state by selectively activating some genes and silencing. The dogma until recently was that cell differentiation was largely fixed unless exposed to the environment of an activated oocyte. However, it is now possible to activate primitive pluripotent genes within adult human cells that take them back in time to a pluripotent state (termed induced pluripotent stem cells). This technology has grown at an exponential rate over the past few years, culminating in the Nobel Prize in medicine. Discussed here are recent developments in the field as they relate to regenerative medicine, with an emphasis on creating functional cells, editing their genome, autologous transplantation and how this ground-breaking field may eventually impact human aging.